DOCUMENT RESUME

ED 264 470 CG 018 698

AUTHOR Boyll, Jeffery R.
TITLE The Effects of Active Exercise versus Passive Electronic Muscle Stimulation on Self-Concept, Anxiety, and Depression.
PUB DATE 85
NOTE 14p.; Paper presented at the Annual Convention of the American Association for Counseling and Development (Los Angeles, CA, April 20-23, 1985). Paper based on an Ed.D. dissertation, Northern Arizona University.
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Anxiety; College Students; *Depression (Psychology); *Exercise; Higher Education; Physical Activity Level; *Self Concept
IDENTIFIERS *Electronic Muscle Stimulation

ABSTRACT

Although positive physiological and psychological changes may occur as a result of exercise, many people do not exercise regularly. Either different methods to ensure exercise adherence must be examined or new ways of acquiring the desired changes must be found. The effectiveness of one alternative method, electronic muscle stimulation, was examined in a group of college students. Three groups, each consisting of seven males and seven females comprised the Exercise, Electrostim, and Control groups. Subjects (N=42), all of whom reported being minimally physically active, completed pre-tests measuring self-concept, anxiety, and depression. The exercise group received a combined aerobic, anaerobic workout for 50 minutes twice a week, the electrostim group received treatments for 50 minutes twice a week, while the control group received no treatments. All subjects were post-tested using the identical measures at the end of 6 weeks. Analysis of variance of gain scores revealed a significant improvement for subjects in both the exercise and electrostim groups in self-concept ($p.<.01$) and anxiety ($p.<.05$) but not in depression. There were no differences found between males and females and neither the exercise nor electrostim programs were significantly better than the other at bringing about this change. It is concluded that either program is a viable approach to reducing anxiety and improving self-concept, with the traditional active exercise program considered the more practical approach. (NRB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED264470

The Effects of Active Exercise Versus Passive Electronic Muscle Stimulation on Self-Concept, Anxiety, and Depression

Jeffery R. Boyll

Department of Educational Psychology

Northern Arizona University

Copyright 1985

CG018698

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Jeffery R. Boyll

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

The Effects of Active Exercise Versus Passive Electronic Muscle Stimulation on Self-Concept, Anxiety, and Depression

July 10, 1985

Abstract

This study examined the effects of an exercise program versus electronic muscle stimulation on 42 physically inactive male and female college students on the following psychological parameters: self-concept, anxiety, and level of depression. The exercise and electrostimulation groups each received treatment 50 minutes a day, twice a week for six weeks in a pre- post-test design with a control group included. 2 X 3 factorial analysis of variance revealed a significant improvement for subjects in both treatment groups in self-concept ($F = 8.03$, $p. < .01$) and anxiety ($F = 5.668$, $p. < .05$) but not in depression level. There were no differences found between males and females and the two treatments did not differ significantly in terms of effectiveness. The feasibility of both methods is discussed.

The relationship between physical and psychological health has been of interest to scientists for years. With the emergence of a growing exercise and fitness conscious public, the effects of such programs in terms of physiological and psychological improvements have become a prime target of study. While the positive effects of exercise on physical fitness is well accepted, expanding research is now being compiled indicating a direct association between improved physical fitness resulting from systematic physical activity and enhanced mental-emotional functioning (Buccola & Stone, 1975; Collingwood, 1976; Folkins, 1976; Hilyer & Mitchell, 1979; Ismail & Tractman, 1973; Johnson, Fretz, & Johnson, 1968).

Participants in various kinds of exercise programs have been found to increase their self-concept, (Cureton, 1963; Johnson, Fretz, & Johnson, 1978; Collingwood & Willett, 1971; Tucker, 1982) decrease levels of anxiety, (Morgan, 1976; McPherson, et al., 1976; Wood, 1977) and decrease levels of depression (Folkins & Sime, 1981; Doyne, et al., 1983; Griest et al., 1979).

Despite its demonstrated and presumed benefits, however, surveys have indicated that roughly two-thirds of Americans still do not exercise regularly and of those who do begin an exercise regimin, whether on their own or in a

structured program, approximately one-half or less will still be exercising after 3 to 6 months (Durbeck, et al., 1973).

It becomes apparent that while positive physiological and psychological changes may occur as a result of exercise, far too many have, and will, neglect this activity for a myriad of reasons, i.e., lack of motivation, lack of time, low energy, monotony, just to name a few. For many, the general sentiment is, "I'd really love to be more physically fit, trimmer, stronger, healthier, if only I didn't have to go through all the damn exercising." Consequently, either different methods to ensure exercise adherence must be examined or new ways of acquiring the desired changes must be found.

This study examines the effectiveness of one such alternative method, a purely passive form of exercise: electronic muscle stimulation. Current research indicates that electronic stimulation of normal, healthy human skeletal muscle has the potential to bring about the physiological changes similar to that of normal strength and exercise training programs. Namely, increases in muscular size, contractile efficiency, and strength (Laughman, Youdas, Barret, & Chao, 1983) and a breakdown and reduction of fatty adipose tissue (Bailey, 1976). Thus, electronic muscle stimulation is as comparably effective in improving physical fitness as traditional exercise. However, in order to examine the relative effectiveness of electronic muscle stimulation in bringing about the same psychological improvements cited earlier which apparently accrued from exercise programs, these two approaches were compared. Further, an assessment of differences between males and females on these parameters was examined. Thus, the purpose of this investigation was to assess the effects of an active exercise program versus a passive electronic muscle stimulation program in affecting change in physically inactive male and female adults in Self-Concept, as measured by the Tennessee Self-Concept Scale (T.S.C.S., Fitts, 1965); Anxiety, as measured by the State-Trait Anxiety Inventory (S.T.A.I., Speilberger,

Gorsuch, & Luschene, 1968) and Depression, as measured by the Self-Rating Depression Scale (S.D.S., Zung, 1965).

Method

The exercise group was comprised of twenty new enrollees volunteering from University Beginning Weight Training/Conditioning classes who were found to be "physicall inactive" through a self-report questionnaire. Forty subjects volunteering from lower division Career Development classes and from the general student population who wished to take part in a "physical" improvement program and were also assessed to be "physically inactive" were randomly placed into the electrostimulation and control groups. All subjects were pre-tested with the T.S.C.S., S.T.A.I., and S.D.S.

The exercise group performed a combined aerobic, anaerobic workout, 50 minutes per day, twice a week under the supervision of University instructors. The electrostimulation group received 50 minutes, twice a week electronic muscle stimulation treatments from the experimenter and an assistant. These treatments consisted of electronically stimulating eight major skeletal muscle groups (i.e., quadriceps, abdominals, etc.) in the exact manner prescribed by the medical staff of the Nu-Med Surgical Company, and the manufacturers of the Electro-Stim 180 electronic muscle stimulator. The control group was told they had been put on a waiting list and were contacted periodically. Following six weeks, all groups were post-tested using the same psychological measurements. At the conclusion of the study these control subjects were offered participation in electronic muscle stimulation treatments, if they so desired.

Results & Discussion

Since adherence was critical, any subjects missing two or more treatments in either treatment group were dropped from the study. In total five subjects from the electrostim group lacked the adequate participation necessary to be

included. The final analysis was conducted using fourteen subjects in each group, equally divided by sex, hence 42 subjects in total.

One-way analysis of variance were calculated on the pre-test scores for each dependent variable to ensure group equivilence. No significant F ratios ($p. < .05$) were found. However, as recommended by Cook and Campbell (1979) a data analysis that takes into consideration both pre- and post-test scores was warranted. Thus, the data in the present study was analyzed using gain scores, which examine the change or difference between pre- and post-test scores. The mean gain scores for each group are provided in Table 1.

Table 1
Mean Gain Scores for all Experimental Groups
on T.C.S.C., S.T.A.I., and S.D.S.

Groups	Exercise (N=14)	Electrostim (N=14)	Control (N=14)
	Self-Concept		
Males	32.4	24.1	.71
Females	34.1	23.6	6.4
	Anxiety		
Males	17.9	16.3	2.5
Females	9.7	12.3	1.7
	Depression		
Males	2.3	2.9	.28
Females	1.8	.14	.14

To test the effects of treatment on self-concept an analysis of variance was computed on the T.S.C.S. gain scores for all subjects. A significant F ($F = 8.03$, $p. < .01$) was found for experimental groups. Orthogonal contrasts and a Newman-Keuls analysis revealed the difference to lie between the two treatment groups and the control group, i.e., both males and females who participated in an exercise program and an electronic muscle stimulator program significantly improved their self-concepts. The present study confirms the conclusions reached by Cureton (1968), Collingwood (1971), Tucker (1982), and others in earlier

studies which found significant improvements in self-concept in subjects who participated in exercise and weight training programs.

Inspection of the individual T.S.C.S. subscales revealed significant improvements in treatment subjects' Physical Self and Personal Self, areas which measure the self as viewed by the self, rather than the self as perceived in relation to family, God, and friends. This suggests that the positive effect of both treatment programs primarily focus on the personal components of the self-concept, with the greatest impact occuring in the most logical dimension, the Physical Self or body image.

Further, the present study reveals that the passive form of exercise, electronic muscle stimulation, is also effective in bringing about significant overall self-concept improvement over control subjects. When comparing the mean effectiveness of the two treatments versus each other, however, the traditional exercise program is found to be slightly more effective, but not to a statistically significant degree. It is important to note, however, that while the control group and electronic muscle stimulation group began the study with nearly identical pre-test means in self-concept, the exercise group scored lower in pre-test self-concept scores. Yet, following treatment, the exercise group surpassed both the control and the electronic muscle stimulation groups on this measure. This trend goes against intuition and lends support to the superiority of the exercise treatment over the electronic muscle stimulation treatment in improving subjects' self-concepts.

How and why does this change take place? While many of the answers remain unknown, the present study does lend credence to the theoretical connectedness between mind and body. The data indicates that an individual's emotional state, particularly in the area of self-esteem, is related to, and can be altered by, physical changes. It appears that out of shape, physically dissatisfied individuals, such as those used in the present study, may significantly improve

their self-concept through a physical improvement program. Further, an exercise program or an electronic muscle stimulation program are both effective in bringing about this change.

The second hypothesis regarding the effects of treatment on anxiety was tested by using a 2 X 3 analysis of variance of subjects' S.T.A.I. gain scores. Again, the only significant F ratios ($F = 5.668$, $p. < .05$) found were among the experimental groups. Post hoc analysis revealed that the differences were due to a significant decrease in anxiety level for subjects in treatment group A (Exercise) and treatment group B (Electronic Muscle Stimulation) over control subjects. While both modes of treatment were able to bring about significant improvement, neither method was found to be more effective than the other.

That an exercise program, such as that used in the present study, can markedly reduce anxiety levels confirms the earlier research by McPherson, et al. (1967); Folkins, Lynch, and Gardner (1972); Blumenthal (1982) and others. Why a passive form of exercise such as electronic muscle stimulation works equally well seems to raise more questions than it answers. For those who have physically worked or exercised hard and experienced the subsequent relaxive repose, the idea of exercise reducing anxiety level is understandable. But why would sitting passively, receiving electrical stimulation into a muscle group forcing it to contract, bring about the same effect? One hypothesis is that the effectiveness of electronic muscle stimulation in reducing anxiety is similar in principle to Jacobsen's (1938) Progressive Relaxation Procedure in which the progressive tensing and relaxing of muscles from head to toe ultimately facilitates an extremely relaxed state. Oftentimes subjects in the electronic muscle stimulation group made comments at the conclusion of a session such as, "I feel great now," or "I always feel a lot better after I come here." By the same token, comments such as "I worked out this morning and I've felt great all day", and "A good, hard workout takes all of my tensions and frustrations away" are comments heard by exercisers.

Exactly what produces a reduction in anxiety for both exercisers and those who undergo electronic muscle stimulation treatments is unclear. It could be a feeling of accomplishment, biochemical changes, such as the release of endorphins, or simply diverting attention away from the source of anxiety. These questions may provide the impetus for future research.

To test the effects of treatment on depression level, the data was tested in the identical manner using a 2 X 3 analysis of variance for all subjects' gain scores on the Self-Rating Depression Scale. No significant F ratios were found, thus neither mode of treatment was effective in reducing level of depression over control subjects. The null hypothesis in this case cannot be rejected. However, a trend does exist towards improved levels of depression for both the treatment groups, which revealed slightly higher levels of depression over controls on the pre-test measure and slightly lower depression levels over control subjects at the time of post-testing. Furthermore, this trend appears to be higher for those subjects participating in the exercise treatment.

While few studies have been conducted using the type of subjects and exercise program utilized in the present study, this data cannot confirm the effectiveness of this type of exercise program or an electronic muscle stimulation program in reducing level of depression.

The data concerning the differences between males and females was first examined in a 2 X 3 analysis of variance including control group subjects and secondly with a 2 X 2 analysis of variance designed to assess differences between the sexes for the two treatment groups only. No differences between the sexes was found on any of the dependent variables for any of the experimental groups.

It is thus concluded that the exercise program utilized in the present study and the electronic muscle stimulation program were both equally effective with males and females at bringing about significant, positive change in

self-concept and levels of anxiety. Further, they were equally ineffective for both sexes in altering levels of depression. However, there was a slight trend towards increased reduction of anxiety and depression for males over females in both treatment groups.

Major Conclusions and Implications

The major conclusion drawn from the present study is that both an active exercise program and a passive electronic muscle stimulator program are effective in improving self-concept and level of anxiety in male and female subjects. As such, there is efficacy for mental health professionals to utilize either mode of treatment in working with clients. Further research is needed, however, to determine the relative effectiveness of exercise programs and electronic muscle stimulation programs versus other, more traditional methods of improving self-esteem and reducing anxiety in clients.

While the two treatment approaches were found to be equally effective in the present study, a more careful comparison between the two approaches provides valuable information for the mental health care professional considering their use. First, and foremost, exercise programs can be carried out by the client outside of the office on the client's own time. Electronic muscle stimulation requires an office and a trained professional to administer treatment, hence it is more costly and time consuming. Secondly, the problem of adherence to a physical improvement program, that might have been diminished through the passive form of exercise in which the client does not have to do the work, was not allieviated. The subject attendance rate was nearly equal for the electrostim group as for the exercise group. Interestingly, just as some individuals love exercise and swear by it while others find it distasteful, some subjects in the present study found electronic muscle stimulation to be nothing short of a modern-day miracle, while others found it to be undesirable. Thus, while both

methods are apparently effective in providing both positive physiological and psychological improvements, the current status of electronic muscle stimulation does not appear to compete with the more easily administered and more cost effective active exercise program. However, in the event that an individual cannot participate in an active form of exercise due to illness, injury, handicap, etc., the method of electronic muscle stimulation appears to have tremendous potential for working with these special populations.

Two further implications of this study are that: 1) the physically inactive general population may enhance certain areas of their psychological well-being through exercise and increased fitness, and 2) clinicians may find either program, the traditional active exercise being more feasible, to be a valuable and successful adjunct to current therapeutic approaches with selected clients. Further research is needed regarding the use of electronic muscle stimulation in the area of mental health, as this is a new idea and virtually untried.

References

Bailey, H. R. (1976). Localized tissue reduction. The Medical Journal of Australia, 1, 780-781.

Buccola, V., & Stone, W. (1975). Effects of jogging and cycling programs on physiological and personality variables in aged men. Research Quarterly, 46, 134-139.

Collingwood, T. R. & Willet, L. (1971). Effects of physical training upon self-concept and body attitude. Journal of Clinical Psychology, 27, 411-412.

Collingwood, T. R. & Willet, L. (1976). The effects of physical training on mood. Journal of Clinical Psychology, 32, 385-388.

Cook, T., & Campbell, D. (1979). Quasi-experimentation: design and analysis for field settings. Boston: Houghton Mifflin Company.

Cureton, T. K. (1963). Anatomical, physiological, and psychological changes induced by exercise programs in adults. In S. C. Staley (Ed.), Exercise and Fitness. Champaign, IL: Athletic Institute Press.

Durbeck, D. L., Heinzelmann, F., & Schacter, J. (1972). The national aeronautics and space administration versus public health evaluation and enhancement program. American Journal of Cardiology, 30, 784-790.

Fitts, W. H. (1965). Tennessee Self-Concept Scale (Manual). Los Angeles: Western Psychological Services.

Fitts, W.H. (1971). The self-concept and self-actualization. Research Monograph, No. 3, Copyright 1971 by William H. Fitts, Ph.D.

Folkins, C.H. (1976). Effects of physical training on mood. Journal of Clinical Psychology, 32, 385-388.

Folkins, C.H., Lynch, S., & Gardner, M.M. (1972). Psychological fitness as a function of physical fitness. (Archives of Medicine and Rehabilitation, 53, 503.

Folkins, C.H., & Sime, W.E. (1981). Physical fitness training and mental health. American Psychologist, 36, 373-389.

Hilyer, J.C., & Mitchell, W. (1979). Effect of systematic physical fitness training combined with counseling on the self-concept of college students. Journal of Counseling Physical, 26, 427-436.

Ismail, A. H., & Trachtman, L. E. (1973,June). Jogging the imagination. Psychology Today, pp. 79-82.

Laughman, K., Youdas, J., Garret, T., & Chao, E. (1983). Strength changes in normal quadriceps femoris muscle as a result of electrical stimulation. Physical Therapy, 63, 494-499.

Morgan, W. P. (1976). Psychological consequences of vigorous physical activity and sport. The Academy of Physical Education, 35, 22-31.

Speilberger, C. D., Gorsuch, R.L. & Luschene, R. (1968). S.T.A.I. Manual of the State-Trait Anxiety Inventory. Palo Alto, CA: Consulting Psychologists Press.

Tucker, L. (1982). Effect of a weight training program on the self-concept of college males. Perceptual and Motor Skills, 54, 1055-1061.

Wood, D. T. (1977). The relationship between state anxiety and acute physical activity. American Corrective Therapy Journal, 31, 67.

Zung, W. W. K. (1965). A self-rating depression scale. Archives of General Psychiatry, 12, 63-70.

Zung, W. W. K. (1973). Evaluation of depression. Archives of General Psychiatry, 29, 331-337.

This article is based on a dissertation submitted to the Department of Educational Psychology of Northern Arizona University in 1985 in partial fulfillment of the requirements for the Ed.D. degree. The author would like to express special appreciation to Dr. Jettie McWilliams for continued guidance and assistance as dissertation advisor. In addition, the assistance in research design and statistics from Dr. Arnold Danzig, and from committee members Dr. John Bloom, Dr. Craig Sidles, and Dr. Tom Vanderhoof is gratefully acknowledged.